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of strain in long slender structures. Bragg gratings are particularly valuable for making local strain measurements while the Optical Time Domain Reflectometry method is ideally suited for making global strain measurements such as the average strain over the length of a riser or several risers.

Rem 8/13/07  
[006 A] Fiber optics technology has matured rapidly in recent years with emphasis for use both in communications and for structural monitoring. U.S. Pat. No. 6,550,342 to Croteau, et al. disclose a non-intrusive method for measurement of the flow characteristics of a fluid in a pipeline based on an apparatus for varying the gain (sensitivity) of an fiber optic sensor using a circumferential strain attenuator. U.S. Pat. No. 6,271,766 to Didden, et al. discloses a fiber optics sensing system focused on the measurement of pressure, temperature, liquid fraction, flow, acoustic, seismic, resistivity, corrosion, and pipe wall build-up. The system records the data in a manner which allows selective billing only for the specific measurement services provided. U.S. Pat. No. 5,649,035 to Zimmerman, et al. discloses a fiber optics strain gage patch which measures the local strain response of a structure like a bridge. The strain gage is constructed of circumferential loops of an optical fiber to increase the strain measurement sensitivity and uses OTDR instrumentation to measure the strain.

[0007] OTDR is a time of flight method which measures spatial positions along an optical fiber by launching brief pulses of laser light into one end